Citation:

Janssen I. Morbidity and mortality risk associated with an overweight BMI in older men and women. *Obesity* (Silver Spring). 2007 Jul; 15 (7): 1,827-1,840.

PubMed ID: 17636102

Study Design:

Prospective Cohort Study

Class:

B - Click here for explanation of classification scheme.

Research Design and Implementation Rating:

POSITIVE: See Research Design and Implementation Criteria Checklist below.

Research Purpose:

To examine the risks of a wide range of weight-related health outcomes associated with an overweight body mass index (BMI) in a large prospective population-based study of men and women age 65 and older.

Inclusion Criteria:

- 65 years of age or older
- Non-institutionalized
- Did not require a proxy respondent at baseline.

Exclusion Criteria:

BMI of <20kg/m.^{2}

Description of Study Protocol:

Recruitment

- Participants were from the Cardiovascular Health Study (CHS), a population-based longitudinal study of coronary heart disease and stroke in adults 65 years of age and older
- Participants were samples from Medicare eligibility lists in each study area: Forsyth County, NC; Washington County, MD; Sacramento County, CA and Pittsburgh, PA
- The current study is a secondary analysis of CHS data in participants with BMI <20kg/m^2.

Design

Prospective cohort study.

Dietary Intake/Dietary Assessment Methodology

Not applicable.

Blinding Used

Not applicable.

Intervention

Not applicable.

Statistical Analysis

- Cox proportional hazards regression models were used to estimate the adjusted hazards ratios of the outcome measures associated with the BMI categories, with the normal weight category as the reference group
- Regression analyses were also stratified by sex, age and smoking exposure to examine effect modification
- For mortality, participants were followed until nine years after their baseline examination or until death, whichever came first.

Data Collection Summary:

Timing of Measurements

- Weight and height were measured at baseline
- Mortality and myocardial infarction/stoke were ascertained for up to nine years
- Diabetes status was measured in the baseline, three-year and seven-year follow-up examinations
- Cancer status was measured at baseline, one-year, three-year and four-year follow-up examinations.

Dependent Variables

- Mortality: Death was confirmed through reviews of obituaries, medical records, death certificates and the US Health Care Financing Administration healthcare utilization database for stays in hospital
- Myocardial infarction and stroke: Self-report and from the US Health Care Financing Administration healthcare utilization database of ICD codes
- Type 2 diabetes: Blood glucose levels in a fasting state and in response to an oral glucose challenge
- Cancer: Self-reports of physician-diagnosed cancer.

Independent Variables

BMI: Weight and height were measured at baseline and participants were classified as normal weight ($<24.9 kg/m^2$), overweight ($25-29 kg/m^2$), and obese ($\geq 30 kg/m^2$).

Control Variables

- Sex
- Age
- Socioeconomic status
- Smoking status

- Physical activity.

Description of Actual Data Sample:

- *Initial N:* 4,968
- *Attrition (final N):* 4,968 (44.6% men)
- *Age:*
  - 65-70 years (42.5%)
  - 71-76 years (32.7%)
  - 77-82 years (18.3%)
  - At least 83 years (6.5%)
- *Ethnicity:* 94.8% white
- *Other relevant demographics:* None listed
- *Anthropometrics:*
  - 20.3% with prevalent disease at baseline
  - BMI at baseline:
    - 36.8% normal weight
    - 44.3% overweight
    - 18.9% obese
- *Location:* US counties in Maryland, Pennsylvania, North Carolina and California.

Summary of Results:

Key Findings

- In the final adjusted model, the risk estimates for all-cause mortality 11% lower in the overweight group and 17% lower in the obese group compared to the normal weight group ($P<0.05$)
- Compared with the normal weight group, the hazards ratio for myocardial infarction, stroke and cancer were not different in the overweight BMI group ($P>0.05$)
- The risk for developing diabetes was increased by 78% within the overweight BMI group (vs. normal weight group, $P<0.01$).

Variables	Normal Weight: 20-24.9 kg/m^2 (Reference Group)	Overweight: 25-29.9 kg/m^2 Hazard Ratio (95% CI)	Obese: 25-29.9 kg/m^2 Hazard Ratio (95% CI)
All-cause mortality[a]	1.00	0.89 (0.80, 0.99)*	0.83 (0.71, 0.97)*
Myocardial infarction[b]	1.00	1.16 (0.96, 1.39)	1.16 (0.91, 1.47)
Stroke[c]	1.00	1.78 (1.24, 2.57)	1.11 (0.87, 1.42)
Type 2 diabetes[d]	1.00	1.78 (1.24, 2.57)*	4.15 (2.82, 6.12)*

Cancer[e]	1.00	0.94 (0.77, 1.16)	1.19 (0.91, 1.54)

*P<0.05

[a]: Adjusted for age, sex, race, socioeconomic status, smoking, physical activity, prevalent disease

[b]: Adjusted for age, sex, race, socioeconomic status, smoking, physical activity, previous coronary heart disease events

[c]: Adjusted for age, sex, race, socioeconomic status, smoking, physical activity, previous stroke events

[d]: Adjusted for age, sex, race, socioeconomic status, smoking, physical activity

[e]: Adjusted for age, sex, race, socioeconomic status, smoking, physical activity, history of cancer (at least five years prior to baseline examination)

Other Findings

The effects of an elevated BMI on decreasing mortality risk were particularly apparent in the oldest (≥ 75 years) age group and those in the lowest smoking exposure category.

Author Conclusion:

A BMI in the overweight range was associated with some modest disease risks, but a slightly lower overall mortality rate.

Reviewer Comments:

Study Strengths

- *Body weight and height were measured*
- *Diabetes was assessed by glucose measurements*
- *Mortality was confirmed by records and stroke or myocardial infarction medical records were also used*
- *Final model was adjusted for several risk factors and interaction was assessed.*

Study limitations

- *Waist circumference was not measured to help assess body fat distribution*
- *Cancer diagnosis was based on self-report.*

Research Design and Implementation Criteria Checklist: Primary Research

Relevance Questions

1.	Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (Not Applicable for some epidemiological studies)	N/A

2.	Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about?	Yes
3.	Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to nutrition or dietetics practice?	Yes
4.	Is the intervention or procedure feasible? (NA for some epidemiological studies)	N/A

Validity Questions

1.	**Was the research question clearly stated?**	Yes
1.1.	Was (were) the specific intervention(s) or procedure(s) [independent variable(s)] identified?	Yes
1.2.	Was (were) the outcome(s) [dependent variable(s)] clearly indicated?	Yes
1.3.	Were the target population and setting specified?	Yes
2.	**Was the selection of study subjects/patients free from bias?**	Yes
2.1.	Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study?	Yes
2.2.	Were criteria applied equally to all study groups?	Yes
2.3.	Were health, demographics, and other characteristics of subjects described?	Yes
2.4.	Were the subjects/patients a representative sample of the relevant population?	Yes
3.	**Were study groups comparable?**	Yes
3.1.	Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)	N/A
3.2.	Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline?	N/A
3.3.	Were concurrent controls used? (Concurrent preferred over historical controls.)	N/A
3.4.	If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis?	Yes

3.5.	If case control or cross-sectional study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.)	N/A
3.6.	If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?	N/A
4.	**Was method of handling withdrawals described?**	Yes
4.1.	Were follow-up methods described and the same for all groups?	???
4.2.	Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.)	N/A
4.3.	Were all enrolled subjects/patients (in the original sample) accounted for?	Yes
4.4.	Were reasons for withdrawals similar across groups?	???
4.5.	If diagnostic test, was decision to perform reference test not dependent on results of test under study?	N/A
5.	**Was blinding used to prevent introduction of bias?**	Yes
5.1.	In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate?	N/A
5.2.	Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.)	N/A
5.3.	In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded?	Yes
5.4.	In case control study, was case definition explicit and case ascertainment not influenced by exposure status?	N/A
5.5.	In diagnostic study, were test results blinded to patient history and other test results?	N/A
6.	**Were intervention/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were interveningfactors described?**	Yes
6.1.	In RCT or other intervention trial, were protocols described for all regimens studied?	N/A
6.2.	In observational study, were interventions, study settings, and clinicians/provider described?	Yes
6.3.	Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect?	Yes
6.4.	Was the amount of exposure and, if relevant, subject/patient compliance measured?	N/A

6.5.	Were co-interventions (e.g., ancillary treatments, other therapies) described?	N/A
6.6.	Were extra or unplanned treatments described?	N/A
6.7.	Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups?	N/A
6.8.	In diagnostic study, were details of test administration and replication sufficient?	N/A
7.	**Were outcomes clearly defined and the measurements valid and reliable?**	Yes
7.1.	Were primary and secondary endpoints described and relevant to the question?	Yes
7.2.	Were nutrition measures appropriate to question and outcomes of concern?	N/A
7.3.	Was the period of follow-up long enough for important outcome(s) to occur?	Yes
7.4.	Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures?	Yes
7.5.	Was the measurement of effect at an appropriate level of precision?	???
7.6.	Were other factors accounted for (measured) that could affect outcomes?	Yes
7.7.	Were the measurements conducted consistently across groups?	Yes
8.	**Was the statistical analysis appropriate for the study design and type of outcome indicators?**	Yes
8.1.	Were statistical analyses adequately described and the results reported appropriately?	Yes
8.2.	Were correct statistical tests used and assumptions of test not violated?	Yes
8.3.	Were statistics reported with levels of significance and/or confidence intervals?	Yes
8.4.	Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)?	N/A
8.5.	Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)?	N/A
8.6.	Was clinical significance as well as statistical significance reported?	No
8.7.	If negative findings, was a power calculation reported to address type 2 error?	No
9.	**Are conclusions supported by results with biases and limitations taken into consideration?**	Yes
9.1.	Is there a discussion of findings?	Yes

9.2.	Are biases and study limitations identified and discussed?	Yes
10.	**Is bias due to study's funding or sponsorship unlikely?**	Yes
10.1.	Were sources of funding and investigators' affiliations described?	Yes
10.2.	Was the study free from apparent conflict of interest?	Yes